

REMARKS

Applicants thank the Examiner for the very thorough consideration given the present application.

Claims 1-10 are now present in this application. Claims 1, 6, 10, 15, 18, 19 and 20 are independent.

Amendments have been made to the Title, Abstract of the Disclosure and specification, and claims 3 and 7 have been amended. Reconsideration of this application, as amended, is respectfully requested.

Priority Under 35 U.S.C. § 119

Applicants thank the Examiner for acknowledging Applicants' claim for foreign priority under 35 U.S.C. § 119, and receipt of the certified priority document.

Drawings

Applicants have not received any indication of whether or not the formal drawings have been approved by the Draftsperson. Since no objection has been received, Applicants assume that the drawings are acceptable and that no further action is necessary. Confirmation thereof in the next Office Action is respectfully requested.

Title of the Invention

Applicants have amended the Title of the Invention in order to better reflect the subject matter claimed.

Abstract of the Disclosure

Applicants have amended the Abstract of the Disclosure in order to place it in better form.

Substitute Specification

In accordance with MPEP §608.01(q), Applicants herewith submit a substitute specification in the above-identified application. Also included is a marked-up copy of the original specification which shows the portions of the original specification which are being added and deleted. Applicants respectfully submit that the substitute specification includes no new matter and that the substitute specification includes the same changes as are indicated in the marked-up copy of the original specification showing additions and deletions.

Because the number of amendments which are being made to the original specification would render it difficult to consider the case, or to arrange the

papers for printing or copying, Applicants have voluntarily submitted this substitute specification. Accordingly, Applicants respectfully request that the substitute specification be entered into the application.

Claim Objections

The Examiner has objected to claims 3 and 7 because of several informalities. In order to overcome this objection, Applicants have amended claims 3 and 7 in order to correct the deficiencies pointed out by the Examiner. Reconsideration and withdrawal of this objection are respectfully requested.

Claim Amendments

Applicants have amended the claims in order to place the claims in better form. The claim amendments are not being made in response to any statutory requirement for patentability, and have not been narrowed in scope. Instead, the claims have been amended merely to recite the subject matter therein more clearly.

Rejection Under 35 U.S.C. § 102/103

Claims 1-10, 14-17 and 19 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Saeki et al. (Saeki), and claims 11-13, 18 and 20 stand

rejected under 35 U.S.C. § 103(a) over Saeki, in view of Moriyama et al. (Moriyama). These rejections are respectfully traversed.

Complete discussions of the Examiner's rejection are set forth in the Office Action, and are not being repeated here.

The Examiner asserts that VOBs (video objects) are stream objects because data in the VOBs is used to create an MPEG stream. The Applicants respectfully disagree.

Video Objects (VOBs) and Video Object Units (VOBUs) are well defined in the art, and are consistently defined by the following definitions:

VOB (Video Object)

A single, complete file composed of multiplexed Video, Audio, Sub-picture, PCI and DSI elementary streams, and consisting of an integer number of VOBUs.

VOBU (Video Object Unit)

A small (between 0.4 and 1.0 seconds) physical unit of DVD-Video data storage, usually the length of one GOP, that begins with a Navigation pack (NV_PCK) and usually includes an integer number of GOPs.

Saeki, the cited reference, provides that:

Each VOB is recorded into the disc by an optical disc recording apparatus in one consecutive recording. The contents of the VOBs are, for example, a whole or a part of a movie, or a whole or a part of a TV program. Each VOB is composed of a plurality of Video Object Units (VOBUs).

Each VOBU includes AV data corresponding to 0.4 to 1.2 seconds of reproduction. Each VOBU includes at least one GOP (Group of Picture) which is the image data section defined in MPEG2

standard. Each GOP includes at least one I(Intra)-picture defined in MPEG2 standard, where each GOP may also include P (Predictive)-pictures and B (Bidirectionally predictive)-pictures defined in MPEG2 standard.

Saeki, Col. 5, line 65 – Col. 6, line 11

It is apparent from the above-recited portion of Saeki that a length of a VOBUs cannot be predetermined. Particularly, the multiple constituents thereof have different sizes, and may be present in either single or multiple units. On the other hand, it appears that Saeki indeed discloses storage positions of the video object units that correspond to reproduction points that differ by a predetermined time unit (see abstract of Saeki). However, the periods of the reproduction points overlap with the lengths of the VOBUs, and as a result, start times must be adjusted in order to correct an offset (Saeki, Col.10, line 30 thru Col.11, line 9). Even when the offset equals zero, the calculations (though simpler) are still performed (Saeki, Col.10, lines 52-64).

Saeki appears to contains some built-in adjustment considerations because the predetermined time unit is longer than a maximum reproduction period of a video object unit (see abstract of Saeki). Of course, this would not be necessary if the lengths of VOBUs were either predetermined, or at least predictable. While the overlap is beneficial, it inherently creates an out of sync condition that would not be present if the lengths of VOBUs were known

beforehand. With predetermined lengths of VOBUs, the complexity of the search could be significantly reduced.

The stream object units of the Applicants' claimed invention have a predetermined length. This is in contrast with Saeki. Further, the stream objects of the Applicants' claimed invention have a predetermined number of stream object units. Saeki only discloses that Each VOB is composed of a plurality of Video object Units (VOBUs).

Therefore Saeki fails to teach a combination of elements in a method for creating and recording search information for recorded digital data streams, recording a received digital data stream by grouping the received digital data stream into stream object units, with each stream object unit having a predetermined length; and creating and recording index information for pointing to the location on the time information for each stream object as management information for stream objects, each stream object consisting of a predetermined number of stream object units, as recited in independent claim 1, or each stream object unit having a predetermined length, as recited in independent claim 15.

With regard to claim 6, it has been provided that in the Applicants' claimed invention, the count value at the constant interval and the length of the stream object unit are one. Therefore, no shift in time information or offset calculation is necessary before recording the time information. In

the Applicants' claimed invention, the time information is recorded on the count value itself for each stream object unit. This allows for pinpoint accuracy in searching, without offset adjustment before recording the time information. In contrast with Saeki, the length of each stream object unit is actually expressed in terms of the count value itself (see claim 10).

Therefore, Saeki fails to teach a combination of elements in a method for creating and recording search information for digital data streams, including recording time information on the count value counted at a constant interval for each stream object, as recited in independent claim 6.

With regard to claim 10, it has been provided above that the search time information is the length of each stream object. Therefore, the length can be expressed in terms of the count value itself, without any offset adjustment. Particularly, Saeki fails to teach a combination of elements in a method for searching recorded digital data streams, including the search time information being the length of each stream object unit, expressed in terms of a count value counted at a constant interval, as recited in independent claim 10.

35 U.S.C. 103(a) Rejection

With regard to independent claim 18, based on the reasons that have been set forth above with respect to independent claim 10, Saeki fails to teach or suggest a combination of elements in a method for searching recorded digital

data streams, including, the search time information being the length of each stream object unit, expressed in terms of a count value counted at a constant interval, as recited in independent claim 18.

With regard to independent claim 19, based on the reasons that have been set forth above with respect to independent claims 1 and 15, Saeki fails to teach or suggest a combination of elements in an apparatus for creating and recording search information for recorded digital streams, including each stream object unit has a predetermined length, as recited in independent claim 19.

With regard to independent claim 20, based on the reasons that have been set forth above with respect to independent claim 10, Saeki fails to teach or suggest a combination of elements in an apparatus for reproducing recorded digital data streams, including the search time information being the length of each stream object unit expressed in terms of a count value counted at a constant interval, as recited in independent claim 20. Moriyama cannot supply these differences.

Reconsideration and withdrawal of these art grounds of rejection is respectfully requested.

With regard to dependent claims 2-5, 7-9, 11-14, 16 and 17, Applicants submit that claims 2-5, 7-9, 11-14, 16 and 17 depend, either directly or indirectly, from independent claim 1, 6, 10 and 15, which are allowable for the reasons set forth above, and therefore claims 2-5, 7-9, 11-14, 16 and 17 are

allowable based on their dependence from claims 1, 6, 10 and 15.
Reconsideration and allowance thereof are respectfully requested.

Additional Cited References

Since the remaining references cited by the Examiner have not been utilized to reject the claims, but have merely been cited to show the state of the art, no comment need be made with respect thereto.

Conclusion

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone Percy L. Square, Registration No. 51,084, at (703) 205-8034, in the Washington, D.C. area.

Prompt and favorable consideration of this Amendment is respectfully requested.

Applicants respectfully petition under the provisions of 37 C.F.R. § 1.136(a) and § 1.17 for a one (1) month extension of time in which to respond to the Examiner's Office Action. The Extension of Time Fee in the amount of \$110.00 is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment: Abstract of the Disclosure (with marked-up copy)
Substitute Specification (with marked-up copy)

ABSTRACT OF THE DISCLOSURE

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In a method for creating and recording management information for searching recorded digital data streams when a digital data stream is recorded on a recording medium, index information for pointing to the location of the time information corresponding to the first stream object unit of each stream object on a time information table is created and recorded. When reproducing or searching the recorded digital data stream, a stream object is found using the time information of stream objects and the recording location corresponding to a requested search time is found using the index information.

MARKED-UP VERSION OF ABSTRACT OF THE DISCLOSURE

A In a method for creating and recording management information for searching recorded digital data streams. ~~When~~ when a digital data stream is recorded on a recording medium, index information for pointing to the location of the time information corresponding to the first stream object unit of each stream object on a time information table is created and recorded. When reproducing or searching the recorded digital data stream, a stream object is found using the time information of stream objects and the recording location corresponding to a requested search time is found using the index information.



**METHOD FOR ~~RECORDING~~ CREATING AND USING SEARCH INFORMATION AND
SEARCHING FOR ~~RECORDED DIGITAL DATA STREAMS~~ USING THE SEARCH
INFORMATION**

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a method for creating search information for searching digital data streams recorded on a recording medium and relates to a method and apparatus for searching for requested data using the search information.

2. Description of the Related Art

[0002] In ~~the~~ a conventional analog television broadcast, video signals are transmitted over the air or through cables after being AM or FM modulated. With the recent advance of digital technologies such as digital image compression or digital modulation/demodulation, standardization for digital television broadcast is in rapid progress. Based upon the Moving Picture Experts Group (MPEG) format, the satellite and cable broadcast ~~industry~~ industries are also moves moving towards the digital

broadcasts.

[0003] The digital broadcast offers several advantages that its analog counterpart cannot provide. For example, the digital broadcast is capable of providing services with far more improved video/audio quality, transmitting several different programs within a fixed bandwidth, and offering enhanced compatibility with digital communication media or digital storage media.

[0004] In the digital broadcast, a plurality of programs encoded based upon the MPEG format are multiplexed into a single transport stream before they are transmitted. The transmitted transport stream is received by a set top box at the receiver and demultiplexed into the original programs. If a program is chosen from among the demultiplexed programs, the chosen program is decoded by a decoder in the set top box and original audio and video signals are retrieved. The retrieved audio and video signals can be presented by an A/V output apparatus such as a TV.

[0005] It is also possible to record the received digital broadcast signals on a storage medium instead of directly outputting the received broadcast signals to A/V output devices. The stored digital broadcast signals can be edited and retrieved afterwards. For example, a digital data stream received by the set top box can be transmitted to a streamer such as a digital video disk (DVD) recording apparatus through communication interfaces ~~like~~ such as an IEEE-1394 serial bus and stored in the streamer. The stored digital data stream can be edited and transmitted back to the set top box so that the digital audio and video data can be presented.

[0006] For recording a received digital broadcast stream on a recording medium, it is necessary to develop schemes

to organize the digital data stream on the recording medium and to create management information for rapid access to the recorded data stream.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide a method for recording received digital data streams on a recording medium as groups of stream objects and creating search information for each stream object and a method for searching for requested data using the search information.

[0008] The method for creating and recording search information for recorded digital data streams in accordance with the present invention comprises the steps of recording a received digital data stream by grouping the received digital data stream into stream object units, creating and recording time information for each stream object unit, and creating and recording index information for pointing to the location on the time information for each stream object as management information for the stream object. When reproducing or editing the recorded digital data streams, the data recording position corresponding to a requested search time can be found with reference to the index information.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The accompanying drawings, which are included to provide a further understanding of the invention, illustrate the preferred embodiments of the invention, and together with the description, serve to explain the principles of the present invention.

[0010] In the drawings:

[0011] FIG. 1 is a block diagram of an apparatus in which the present invention may be advantageously employed;

[0012] FIG. 2 is the syntax of the management information created by the method for creating search information for recorded digital data streams in accordance with the present invention;

[0013] FIG. 3 is a pictorial representation of the stream time map information as a part of the management information created by the method for creating search information for recorded digital data streams in accordance with the present invention;

[0014] FIG. 4 is a pictorial representation for explaining the digital data stream recording operation in accordance with the present invention; and

[0015] FIG. 5 is a pictorial representation for explaining the management information created by the method for creating search information for recorded digital data streams in accordance with the present invention;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] In order that the invention may be fully understood, preferred embodiments thereof will now be described with reference to the accompanying drawings.

[0017] FIG. 1 depicts a block diagram of an apparatus in which the present invention may be advantageously employed. The apparatus comprises a set top box 100, a communication interface (IEEE-1394), and a streamer 200.

[0018] The set top box 100 receives transport streams encoded by system encoders and broadcast by a plurality of broadcasting stations and demultiplexes the received transport streams. After a system decoder 120 decodes the

transport stream of a program tuned by a tuning unit 110, a control unit 140 outputs the decoded transport stream to an A/V output device such as a TV set for presentation.

[0019] The set top box 100 may transmit a program chosen by a user to the streamer 200 through the IEEE-1394 interface so that the transmitted program is recorded on a recording medium 230 such as a digital video disk by the streamer 200.

[0020] ~~Requested~~ Upon a request by a user, the set top box 100 may receive a program retrieved from the recording medium 230 by the streamer 200 through the IEEE-1394 communication interface so that the received program can be presented on a TV set after being decoded by the decoder 120.

[0021] For carrying out these tasks, the set top box 100 and the streamer 200 should be able to access the management information regarding the programs recorded on the recording medium 230. To this end, information files are used to deal with the recorded data. An application information file is utilized by the set top box 100 and a streamer information file is utilized by the streamer 200. A common information file is utilized by both the set top box 100 and the streamer 200. These information files are recorded on the recording medium 230.

[0022] The application information file is retrieved by a stream reproducing unit 240 of the streamer 200 when the set top box 100 is initialized or requests the file. The retrieved application information is transmitted to the set top box 100 through the IEEE-1394 communication interface and loaded into the management information area M2 of a memory 150 by a control unit 140 of the set top box 100. When a new program is recorded or recorded data is edited, the application information loaded in the memory 150 is

updated by the control unit 140 to include management information on the newly recorded or edited program. If a user requests retrieval of a specific program, the control unit 140 requests the streamer 200 to retrieve the program, with reference to the application information. When the set top box 100 terminates a recording mode or is shut down, the application information in the memory 150 is transmitted through the IEEE-1394 communication interface to the streamer 200 and recorded on the recording medium 230 by a stream recording unit 220 controlled by a control unit 250 of the streamer 200.

[0023] The streamer information file and common information file are retrieved by the stream reproducing unit 240 of the streamer 200 when the streamer 200 is initialized and loaded into a memory 260 by the control unit 250 of the streamer 200. When a new program is recorded or recorded data is edited, the streamer and common information is updated to include management information on the newly recorded or edited program by the control unit 250. If a user requests retrieval of a specific program, the control unit 250, responsive to a request signal from the set top box 100 retrieves the associated program recorded on the recording medium 230 with reference to the streamer and common information loaded in the memory 260. When the set top box 100 terminates a recording mode or is shut down, the streamer and common information in the memory 260 are recorded on the recording medium 230 by the stream recording unit 220 controlled by the control unit 250.

[0024] The syntax of the information files and the structure of recorded data will be explained with reference to FIG. 2.

[0025] As shown in FIG. 2, the application information

file (application.IFO) comprises a table of content (TOC) and a service information (SI) table. The table of content (TOC) contains random-access entry points that allow random access to the recorded data stream and the service information (SI) table contains the information on the recorded digital stream. The common information file (common.IFO) contains an original playlist automatically created when a digital data stream is recorded, presentation sequence information (Cell) of the recorded data stream, and a user-defined playlist created when a user edits the presentation sequence of the recorded data stream.

[0026] The streamer information file (streamer.IFO) is intended to deal with stream time map general information (STMAP_GI) and a mapping list (MAPL). The stream time map general information (STMAP_GI) is management information regarding stream object units (SOBUs) organized on the recording medium and stream objects (SOBs) each of which comprises a plurality of stream object units (SOBUs) and the mapping list (MAPL) is time search information regarding the stream object units (SOBUs) and stream objects (SOBs). Each stream object (SOB) has a one-to-one correspondence with each Cell contained in the original playlist and each Cell is contained in the user-defined playlist and has a one-to-one correspondence with each stream object (SOB).

[0027] The stream time map general information (STMAP_GI), as shown in FIG. 3, comprises several fields representing the stream object unit size (MAPU_SZ), the weight of the LSB of the mapping list entries (MTU_SHFT), index number (INDEX_NO) indicating an arbitrary entry of the mapping list (MAPL), the number of mapping list entries (MAPL_ENT_Ns), start packet arrival time (S_SAPAT), and

last packet arrival time (S_E_APAT). The mapping list (MAPL) comprises mapping entries (MAPU_ENT), each mapping entry containing the incremental application packet time (IAPAT).

[0028] The method for creating and recording search information for recorded digital data streams in accordance with an embodiment of the present invention will be explained with reference to FIGS. 1, 2, and 3. If a user ~~asks for requests~~ recording of a received digital data stream on the recording medium 230, the control unit 140 of the set top box 100 notifies the control unit 250 of the streamer 200 that a recording mode has been set and begins to transmit the received digital data stream to the streamer 200 through the IEEE-1394 interface. Concurrently, the control unit 140 of the set top box 100 records the entry point information that allows random access to the transport stream packets of the digital data stream in the application information (application.IFO) loaded in the management information area (M2) of the memory 150 or records the entry point information in the common information (common.IFO) as a part of the playlist. Also, the control unit 140 detects the information on the data stream currently being recorded from the program service information (SI) loaded in the program information area (M1) of the memory 150 and records the service information in the service information (SI) table of the application information (application.IFO).

[0029] The control unit 250 of the streamer 200 controls the stream recording unit 220 so that the data stream received through the IEEE-1394 communication interface is recorded on the recording medium 230. The data stream is organized in sectors on the recording medium 230 and a predetermined number of sectors constitute a stream object

unit (SOBU). ~~Such~~ The process is repeated until the recording mode terminates, thereby creating a stream object (SOB) which is a group of data streams recorded by a single recording operation.

[0030] The control unit 250 of the streamer 200 creates presentation sequence information (Cell) regarding the created stream object (SOB) and records the Cell in the Cell layer of the common information (common.IFO) as presentation sequence information corresponding to the record (RCD) of the original playlist. For searching for stream object units (SOBUs) constituting the stream object (SOB), the time length of every stream object unit (SOBU) is sequentially recorded in the mapping list (MAPL). To be more specific, a count value counted at a constant time interval while a stream object unit (SOBU) is created, namely, the incremental application packet time (IAPAT) is recorded in the mapping entry field (MAPU_ENT) corresponding to the associated stream object unit (SOBU), as shown in FIGS. 4 and 5. In addition, the sum of a predetermined number of incremental application packet times (IAPATs) (the numbers parenthesized in FIG. 5) is calculated and the sum is recorded as a coarse mapping entry (C_MAP_ENT) which is coarse search time information.

[0031] The index number (INDEX_NO) of the first mapping entry (MAPU_ENT) of the mapping list (MAPL) or the first coarse mapping entry (C_MAP_ENT) associated with the stream object (SOB) is recorded in the stream time map general information (STMAP_GI). In FIG. 5, the index number K of the first mapping entry related to the stream object SOB #n is recorded as identification information for indexing the location of the stream object SOB #n.

[0032] If a user requests retrieval of a certain interval of a data stream recorded on the recording medium,

for example recorded data corresponding to the time interval from 10 minutes to 20 minutes, the control unit 150 of the streamer 200 first searches Cells for a Cell (Cell 2 in FIG. 2) having a recording time corresponding to the start time 10 minutes. Then, the control unit 150 detects the index number pointing to the start position of the stream object SOB 2 corresponding to the chosen Cell 2 from the stream time map general information (STMAP_GI). Subsequently, the control unit 150 begins to detect the incremental application packet times (IAPATs), starting from the mapping entry pointed to by the index number. By summing the detected incremental application packet times (IAPATs) and multiplying the sum value by the unit time of each count, the start position of the stream object unit (SOBU) corresponding to the requested search time 10 minutes can be found. Finally, data retrieval begins from the transport stream packet whose packet arrival time coincides with the requested time.

[0033] If a user requests retrieval of the recorded data corresponding to the time interval from 40 minutes to 60 minutes and the Cell having a recording time corresponding to the requested time 40 minutes is Cell 3, the control unit 150 detects the index number pointing to the start position of the stream object SOB 3 corresponding to the chosen Cell 3 from the stream time map general information (STMAP_GI). Subsequently, the control unit 150 begins to detect the incremental application packet times (IAPATs) listed in the mapping list MAPL 3. By summing the detected incremental application packet times (IAPATs) and multiplying the sum value by the unit time of each count, the start position of the stream object unit (SOBU) corresponding to the requested time 40 minutes can be found. Finally, data retrieval begins from the transport

stream packet whose packet arrival time coincides with the requested time.

[0034] The method for creating and recording search information for recorded digital data streams of the present invention enables rapid and precise search of a specific interval of the recorded digital data, provided that the digital data streams are recorded on a recording medium as groups of stream objects.

[0035] The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.